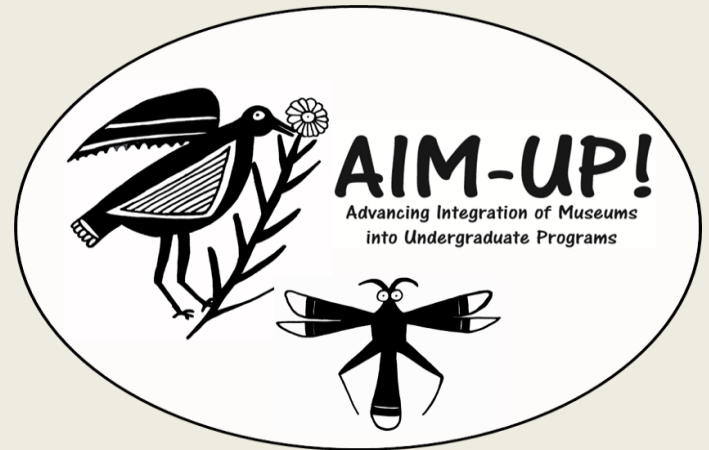


# All-Hands Workshop, 11-13 April 2013

## Museum of Comparative Zoology

### Evolutionary Genomics and the Museum: Enhancing insight into evolutionary processes using museum collections



# An Introduction to AIM-UP! Advancing the Integration of Museums into Undergraduate Education



# What do collections-based approaches add to undergrad education?

- Scale—time and space
- Integration
  - biotic and abiotic
  - genomic to organismal to ecosystems
- Complexity-multiple views
- Web-based Discovery
- Database exposure
- Scientific Process
  - Experiential vs passive



# Challenges



- Few educators (& fewer students) seem to know:
  - about natural history collections
    - or their role in development of key concepts
  - how to access museum information
  - how to incorporate specimen data in teaching

# A Few More Challenges



- Collections (and databases) have limitations
  - Specimen availability
  - Narrow view of possibilities
    - **Systematics**, now to other disciplines
      - (samples plus time and space stamps)
      - “Unintended Consequences”
  - Collections developed for **research**,
    - How do we unleash potential for teaching?
      - (formal and informal)
  - Databases developed for **collection management**, not education or outreach.

# NSF-RCN

## Research Coordinating Network

- Goal: create new directions in research & education by communicating and coordinating activities across disciplinary, organizational, geographic and international boundaries.



# RCN-UBE

- RCN-Undergraduate Biology Education
  - focuses on improved participation and learning in undergraduate biology curricula.



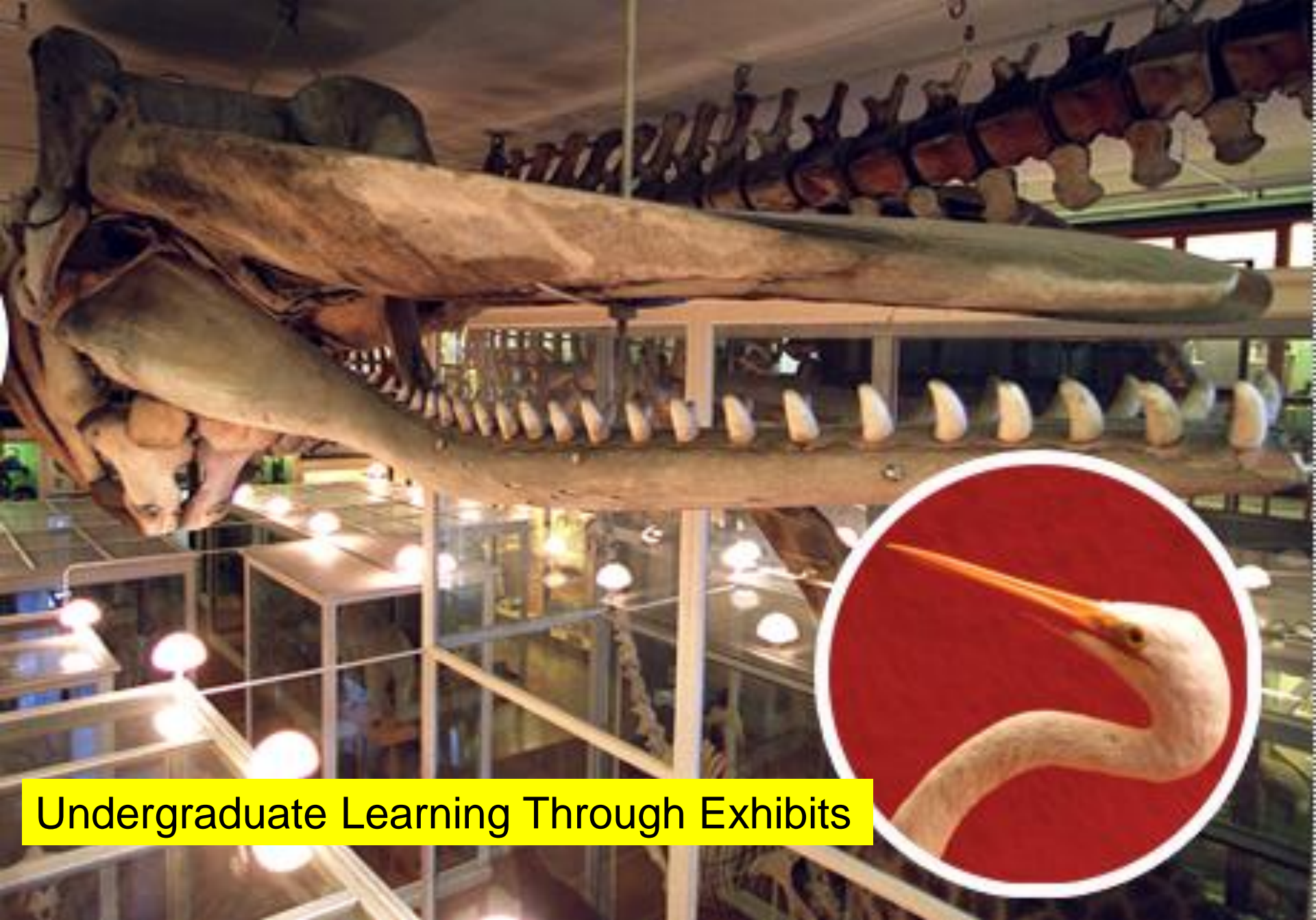
# Undergraduate Experiences in Curation





## Undergraduate Experiences in Museum Fieldwork



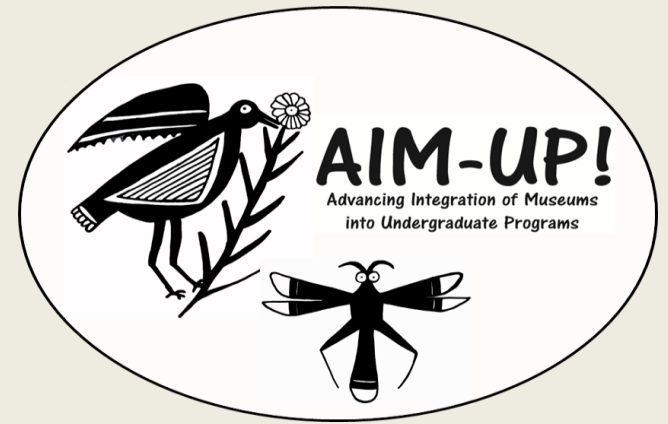


Undergraduate Learning Through Exhibits

# Graduate and Undergraduate Research Experiences Based on Collections

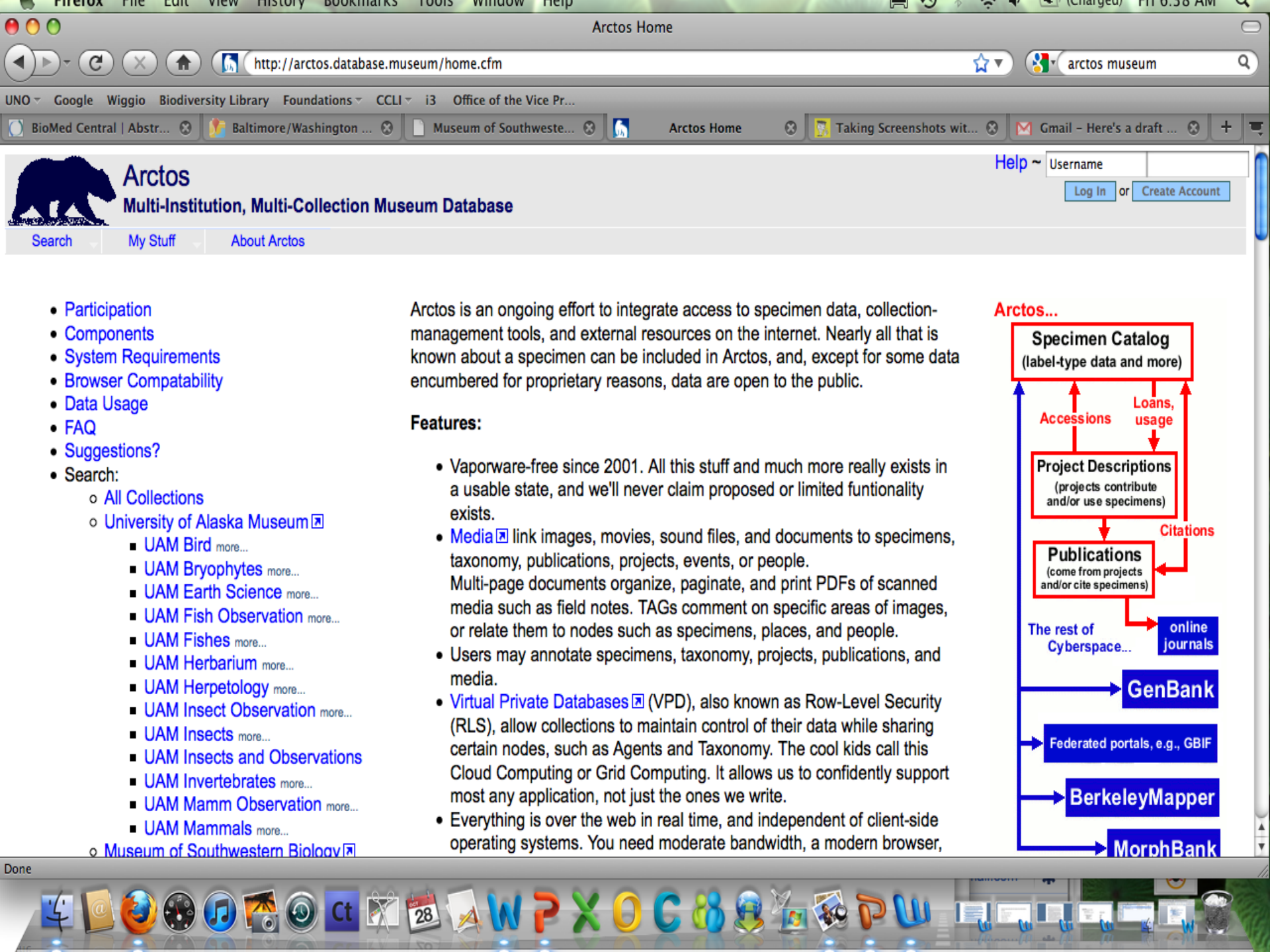


# AIM-UP!



Expand traditional museum experiences

- Develop novel ways of using collections and data.
- Increase accessibility of natural history collections to educators/public through databases.
- Develop tools, guidelines, and “front-end” entry into databases to facilitate on-line use by educators.
- Partner with other non-traditional museum users  
(e.g., Behavior, Geography, Art)
- Develop international collaborations  
– (Latin America & Spanish language)



# Arctos

Multi-Institution, Multi-Collection Museum Database

Help ~ Username   
 or

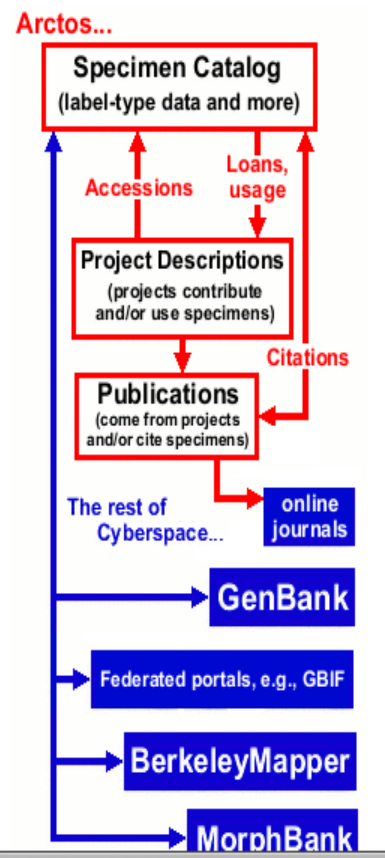
- Search
- My Stuff
- About Arctos

- [Participation](#)
- [Components](#)
- [System Requirements](#)
- [Browser Compatability](#)
- [Data Usage](#)
- [FAQ](#)
- [Suggestions?](#)
- Search:
  - [All Collections](#)
  - [University of Alaska Museum](#)
    - [UAM Bird](#) more...
    - [UAM Bryophytes](#) more...
    - [UAM Earth Science](#) more...
    - [UAM Fish Observation](#) more...
    - [UAM Fishes](#) more...
    - [UAM Herbarium](#) more...
    - [UAM Herpetology](#) more...
    - [UAM Insect Observation](#) more...
    - [UAM Insects](#) more...
    - [UAM Insects and Observations](#)
    - [UAM Invertebrates](#) more...
    - [UAM Mamm Observation](#) more...
    - [UAM Mammals](#) more...
  - [Museum of Southwestern Biology](#)

Arctos is an ongoing effort to integrate access to specimen data, collection-management tools, and external resources on the internet. Nearly all that is known about a specimen can be included in Arctos, and, except for some data encumbered for proprietary reasons, data are open to the public.

### Features:

- Vaporware-free since 2001. All this stuff and much more really exists in a usable state, and we'll never claim proposed or limited functionality exists.
- [Media](#) link images, movies, sound files, and documents to specimens, taxonomy, publications, projects, events, or people. Multi-page documents organize, paginate, and print PDFs of scanned media such as field notes. TAGs comment on specific areas of images, or relate them to nodes such as specimens, places, and people.
- Users may annotate specimens, taxonomy, projects, publications, and media.
- [Virtual Private Databases](#) (VPD), also known as Row-Level Security (RLS), allow collections to maintain control of their data while sharing certain nodes, such as Agents and Taxonomy. The cool kids call this Cloud Computing or Grid Computing. It allows us to confidently support most any application, not just the ones we write.
- Everything is over the web in real time, and independent of client-side operating systems. You need moderate bandwidth, a modern browser,



# AIM-UP!--the network

Universities, Community Colleges, Agencies, Public Museums, High Schools---

**Universities:** UAF, UC Berkeley, Harvard U, UNM  
U Michigan, Texas A&M, U Texas, U Colorado, U Arizona, KU, UAS, UAA,  
CNM, NM Highlands University, Ohio State U, Occidental College,  
Northern Arizona University, U of Florida, Mass

**Agencies and Free-standing Museums:** USDA National Parasite Lab,  
USGS Molecular Ecology Lab, USNM, DMN&S, NY State Museum

**International:** U Guelph, UN-Montevideo

**High Schools:** Highland High (urban) and Sitka High (rural)

# Products

- **Better Understanding of Current Programs**
- **Survey of Educators and Students**
- **Stimulate Interdisciplinary Use of Specimens**
- **Publications—**
  - Perspectives, Surveys, Educational Venues, Texts
- **Educational (Dispersion) modules** centered around themes

**Grow the Community of Users**

# Annual Conceptual Themes:

- 1) Integrative Inventories: Exploring Complex Biotic Associations Across Space and Time (MSB)
- 2) Decoding Diversity: Making Sense of Geographic Variation (UAM)
- 3) **Evolutionary Dynamics of Genomes (MCZ)**
- 4) Fast Forward: Biotic Response to Climate Change (MVZ)
- 5) Coevolving Communities and the Human Dimension (MSB)





# 5 Annual All-Hands Meetings

- Exchange Perspectives on Teaching about *Evolutionary Genomics and the Museum*
- Explore Educational Modules & Dissemination
- Evaluation



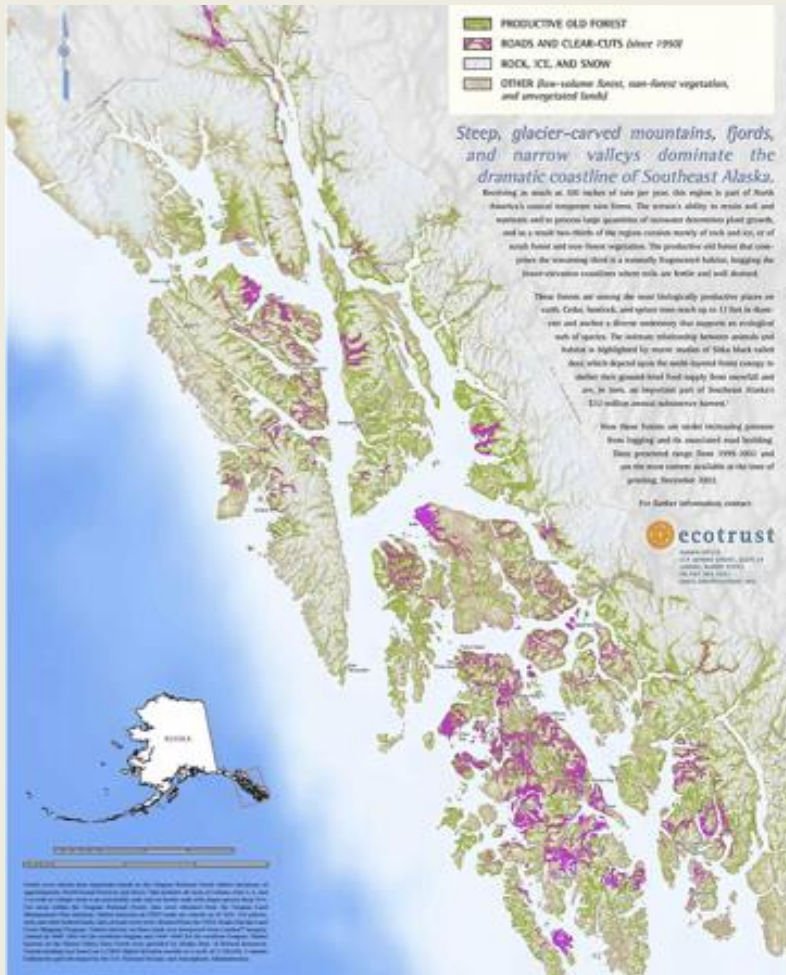
# Workshops & Seminars--Spring 2012



- 1) Fluid Taxonomy -- on the dynamic, ever shifting practice of classification
- 2) Cataloguing Wonder -- collecting through the senses
- 3) Morphology and Evolution -- investigating change in nature and culture through place and time

# Educational Modules

## Island Biogeography: Species Richness Across a Northern Archipelago



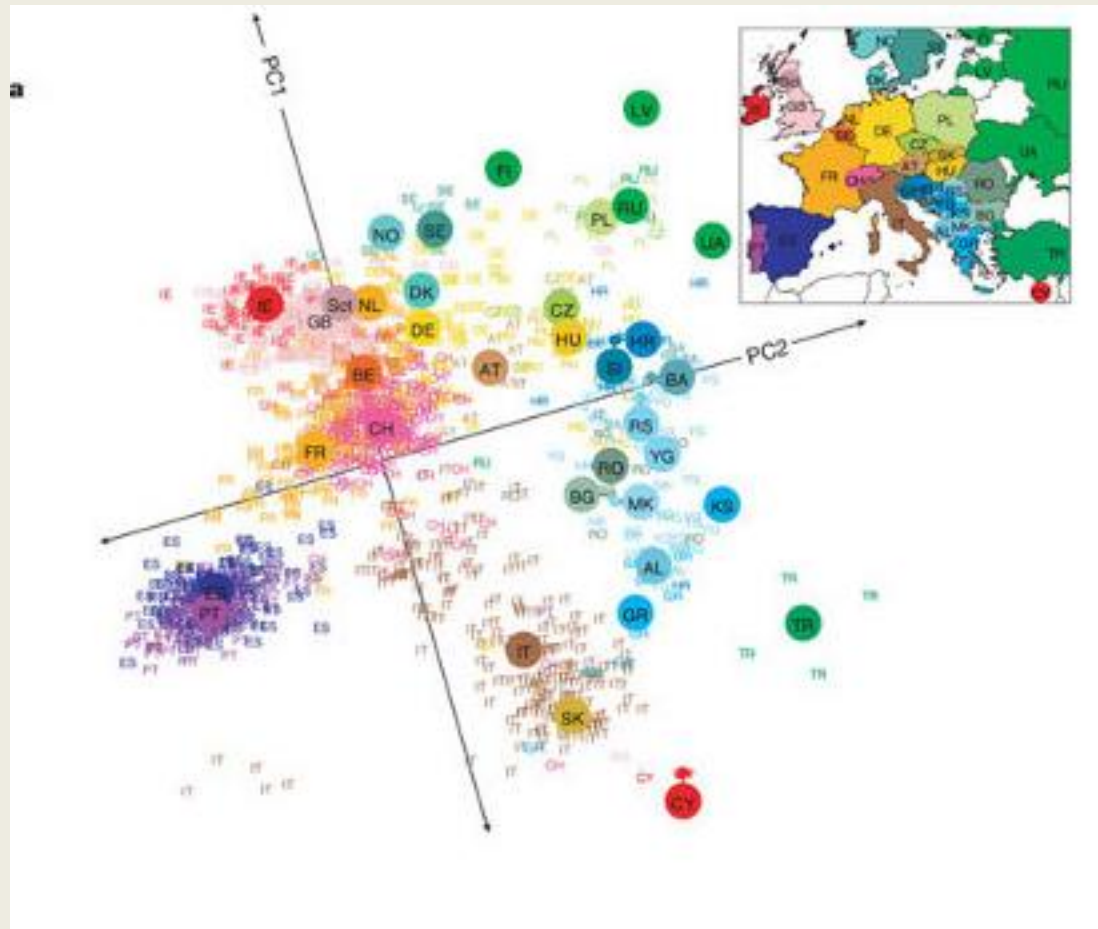
### Key Concepts and Skills: Evolution & Ecology

- Body size on islands
- Competitive exclusion/release
- Isolation and Divergence
- Island biogeography

Conservation biology  
Scientific process & hypothesis testing  
Statistical methods  
Management & analyses of large-scale databases

# Genomes and Museums

Genetic



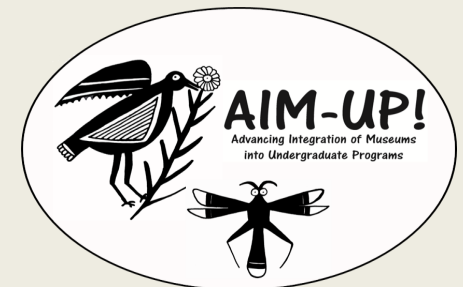
**Genes mirror geography within Europe**

Novembre et al 2008 Nature.

# Evolutionary Genomics and the Museum

## Potential Topics for Educational Modules

- Tree of Life
- Spatial and Temporal Genetic Variation
- Scientific Process (Replication--without vouchers, difficult to impossible)
- Connecting Big Data (GenBank to GIS Applications)
- Genes and Developmental Biology
- Are Museums Supermarkets for Genomics?
- Founder Effects, Island Syndrome



# **PULSE - Partnership for Undergraduate Life Sciences Education**

- Stimulate systemic changes within biology departments
- Follow-up to 2011 Vision and Change Report
- Joint effort by NSF, HHMI and NIH
- 40 Leadership Fellows